

PATENT SPECIFICATION

(11) 1 205 275

DRAWINGS ATTACHED



1 205 275

- (21) Application No. 10483/68 (22) Filed 4 March 1968
- (31) Convention Application No. R34612/34g Gbm (32) Filed 4 March 1967 in
- (33) Germany (DT)
- (31) Convention Application No. R34777/34h Gbm (32) Filed 25 March 1967 in
- (33) Germany (DT)
- (31) Convention Application No. R34848/34i Gbm (32) Filed 5 April 1967 in
- (33) Germany (DT)
- (45) Complete Specification published 16 Sept. 1970
- (51) International Classification A 47 b 13/02
- (52) Index at acceptance
A4H 48 89 W1X
- (72) Inventor PETER RAACKE

(54) COLLAPSIBLE FURNITURE AND BLANKS THEREFOR

(71) I, PETER RAACKE, of Parkstrasse 20, Wolfgang bei Hanau, Germany, a citizen of Germany, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to collapsible furniture and blanks therefor. This furniture has considerable load-bearing strength and may be made of stiff cardboard, particularly corrugated paperboard. The furniture may be in the form of chairs, tables, beds and the like. Such furniture is particularly suitable for nurseries. It is of very light weight and can easily be carried by a child from place to place. Moreover, any risk of injury to a child, which is unavoidably present in normal nursery furniture, is avoided because of the nature of the material used for the proposed furniture and its extremely light weight.

In collapsible tables and chairs, particularly collapsible nursery tables and chairs, of material other than cardboard, for instance of wood or a material resembling wood, collapsibility is achieved by providing hinges and articulations. This kind of collapsible furniture presents a considerable hazard, particularly to babies who can hurt themselves simply by running into such furniture. If in the course of play such a piece of furniture tumbles over, its weight and the hardness of the material of which it is made may very well injure a child. The presence of the hinges and articulations aggravates the risk.

It has already been proposed to use cubical or block-shaped hollow bodies as a material for packing. However, such bodies are not very rigid and cannot carry any appreciable weights.

According to the invention there is provided a single-piece blank comprising panels separated by fold lines such that said panels can be erected by folding about said fold lines and by tuck manipulations to form stable furniture wherein some of said panels can be folded to form hollow prism shaped support elements of triangular cross-section abutting others of said panels which bear loads. The blanks may be made out of stiff cardboard, corrugated paperboard or a suitable plastics material.

In one embodiment of the invention a single-piece blank is provided in which said panels can be folded to form a cube, two of whose opposite faces are each replaced by four reentrant faces forming the sides of a pyramid, the vertices of said pyramids abutting each other at the centre of said cube. The blank for this comprises first, second, third and fourth square panels adjoining each other in sequence to form a rectangular strip, a first flap adjoining said first square panel on the side opposite said second square panel, a second flap adjoining said fourth square panel opposite the side adjoining said third square panel, four isosceles triangular panels each adjoining along its base one side of said first or third square panels respectively, the length of the base being equal to that of a side of the square panel, four right triangular panels each adjoining along its hypotenuse the side of a re-

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spective isosceles triangular panel remote from said second square panel, the remaining sides of the right triangular panel lying parallel to and perpendicular to the sides of the square panel, four square panels each of the same length as and adjoining the edge of a respective right triangular panel lying parallel to the length of said strip, congruent first and second rectangular panels of equal length as and adjoining one on each side said second square panel, congruent third and fourth rectangular panels of half the size of said second square panel and adjoining along their lengths said first and second rectangular panels respectively on the side opposite said second square panel, congruent fifth and sixth rectangular panels of equal length as and adjoining one on each side of said fourth square panel and seventh and eighth rectangular panels adjoining lengthwise said fifth and sixth rectangular panels respectively such that said fifth, sixth, seventh and eighth rectangular panels have a slightly greater width than said first, second, third and fourth rectangular panels respectively.

In another embodiment of the invention a blank is provided in which said panels form two similar side sections and a central section such that said panels can be folded to form a table in which said central section forms the table-top supported by said two side sections forming vertical hollow prismatic support elements of triangular cross-section. The blank for this comprises rectangular first, second and third panels adjoining in sequence to form a rectangular strip, said first and third panels being congruent, four congruent pentagonal panels, whose shape is that of a rectangle with a right triangular extension such that the hypotenuse of said extension forms a side of the pentagon, one adjoining each of the sides of said first and third panels nearest said second panel such that the longest side of each of said pentagons is adjacent and of equal length with the side of said first and third panels and the triangular extension is on the side nearest said second panel, four congruent intermediate rectangular panels each adjoining lengthwise one of said pentagonal panels respectively on the side opposite said first or third panel, four congruent outer rectangular panels each adjoining lengthwise one of said intermediate rectangular panels respectively on the side opposite said pentagonal panels, congruent rectangular first and second side panels each of the same length as and adjoining lengthwise one of the sides of said second panel, third and fourth side panels each of the same length as and adjoining lengthwise one of said first and

second side panels respectively on the sides opposite said second panel, congruent rectangular fifth and sixth side panels of lesser length than and adjoining lengthwise said third and fourth panels centrally on the side opposite said second panel, congruent rectangular seventh and eighth side panels of the same length as and adjoining lengthwise said fifth and sixth side panels respectively as the sides opposite said second panel, four rectangular flaps adjoining said third and fourth said panels respectively such that they are on the same side as and flanking either said fifth and sixth side panels respectively.

In another embodiment of the invention a blank is provided in which the panels can be folded to form a structure into which a plate can be inserted to form a table which may be converted into an easy chair by tipping on its side. The blank for this comprises first, second and third rectangular panels adjoining in sequence to form a rectangular strip, said first and third rectangular panels being congruent, four congruent rectangular side panels one of which adjoins each side of said first and third rectangular panels along the whole of each of the sides nearest said second rectangular panel, four congruent pentagonal panels of which are the shape of a rectangle with a face cut across one corner, one of which adjoins each of said rectangular side panels along the whole of the side further from said first or third rectangular panels respectively, such that the fifth side of the pentagon has been cut across the corner of the rectangle, formed by the other four sides of the pentagon furthest from said second rectangular panel, two symmetric congruent trapezoidal panels each adjoining one side of said second panel along the base of the trapezium, four congruent triangular flaps each adjoining one side of said trapezoidal panels, two hexagonal panels of nearly rectangular shape with two right triangular exteriors at the corners nearest said second rectangular panel each adjoining the top of one of said trapezoidal panels and four incisions in said first and third rectangular panels such that two incisions are made symmetrically in the side of said first or third rectangular panel respectively which forms the lateral edge of said rectangular strip.

Specific embodiments of the invention will be described hereinafter with reference to the accompanying drawings in which:—

Figure 1 is a plan view of a flat blank divided into a plurality of panel portions;

Figure 2 is a perspective view of a cube obtained by folding the panel portions of the blank shown in Figure 1;

Figure 3 is a perspective view of the blank shown in Figure 1 partly folded together;

Figure 4 is a plan view of a flat blank;

5 Figure 5 is a perspective view of the blank shown in Figure 4, partly folded together;

Figure 6 is a perspective view of a nursery table obtained from the blank shown in Figures 4 and 5 by fold-and-tuck manipulations,

Figure 7 is a plan view of a blank for the formation of a table or easy chair;

15 Figure 8 is a perspective view of the blank shown in Figure 7 partly folded;

Figure 9 is a perspective view of a table;

Figure 10 is a perspective view of an easy chair and;

20 Figure 11 is a perspective view of a connecting plate.

The blank 10 in Figure 1 consists of stiff cardboard, preferably corrugated paperboard. The blank has been prepared in the manner usually employed in the production of cartons, and is divided into a plurality of panel portions. The dotted lines in the drawing indicate score lines separating the panels, whereas the dot-dash line identifies an axis dividing the two congruent symmetrical sections 14 and 16 of the blank. Connected to the section 16 is an additional section 18 which has no counterpart on the opposite side of the axis. The centre of the blank 35 extending across the axis comprises four square panels 20, 21, 22, 23. These square panels will form four faces of a cube when the blank has been folded and tucked together as will be described later. The panels 20 and 22 and the panels 21 and 23 will form opposite faces of the cube.

The cube is erected by first folding panels 25, 27, 40 and 29 inwards about the score lines marked in the drawing. The four triangular panels 31 are then folded over towards the adjoining triangular panels 33. The latter panels 33 are then likewise folded inwards and so are the two rectangular panels 35 and the two terminal flaps 37 and 39.

50 When this has been done the entire assembly is folded together about the score lines dividing the central square panels and the several side panels, and the panels can be tucked together to form the completed cube 12 shown in Fig. 2.

To this end the triangular panels 31 are erected so that they lie at an angle to the adjoining triangular panels 33 and the latter are then folded over inwards until their vertices make contact above the centre of the corresponding centre square panel 20 or 22 respectively. This carries the small square panels 25 into a position perpendicular to the centre panel

20 or 22 respectively, in which each of the two small panels 25 that have been folded inwards on opposite sides of the blank are back to back and thus support each other. The rectangular panels 35 and 29 70 are folded inwards until in conjunction with half the area of the square panel 23 they form hollow prisms of right triangular cross section, the two panels 29 being perpendicular to the panel 23 in the centre line thereof and touching back to back, so that they likewise support each other. The two contiguous prisms thus formed together define a larger hollow prism which likewise has a right triangular cross section. The two rectangular panels 27 75 and 40 are folded in analogous manner to the two rectangular panels 35 and 29, so that the former each in conjunction with one half of the centre square 21 likewise form hollow prisms of right triangular cross section. The blank is now folded as shown in Fig. 3.

After the flap 37 has been erected to stand at right angles to the adjoining panel 23, the centre panels 20, 21, 22 and 23 90 are each folded inwards about their dividing score lines so that the angle between each two adjoining centre panels is a right angle. During the erection of panel 20 in relation to panel 21 the two contiguous panels 25 insert themselves between the cooperating panels 40 and come to rest perpendicularly on the surface of panel 21, whereas the sloping free sides of the triangular panels 33 bear down on the backs of the rectangles 27. Analogously the same process is repeated when the centre panel 22 is erected at right angles to panel 21. The vertices of the four 105 triangular panels 33 which coincide with the bottom corners of the panels 25 are now closely juxtaposed at a point which will be the centre of the cube that is about to be formed. A triangular area on the inside of each of the two panels 20 and 22 is still exposed. This is the triangular area bounded by the panels 31 which are perpendicular to and adjacent to the panels 20 and 22. Two opposed pyramidal 115 cavities with a triangular base are thus formed. When the last centre panel 23 is now erected into a position in which it is perpendicular to both the panels 20 and 22 and the flap 37 which is perpendicular to the square 23 is tucked in between the square panel 20 and the edges of the triangles 31 which are perpendicular to and adjacent to the panel 20, the surface of the flap 37 thus bearing flat on the face 125 of panel 20, the hollow prism which has been formed above the panel 23 as previously described will just fit into the two above-mentioned pyramidal spaces in such manner that the outer faces of the tri- 130

angular panels 31 bear against the backs of the two rectangular panels 35. Finally the flap 39 is folded over inwards onto the external face of the panel 23.

- 5 A cube 12 is thus formed in which each of two opposite faces is replaced by four re-entrant faces forming the sides of a pyramid. The base of the pyramid is a square and the sides are formed by four congruent triangular surfaces. The vertices of the two pyramids abut in the body centre of the cube. The cube 12 is thus internally reinforced by panels being folded so that the fold lines formed run along the diagonals of the cube. This rigidification is further improved by the presence of continuous fold lines between and perpendicular to the panels 20, and 22, and 21 and 23 respectively. The cube 20 12 therefore has the greatest bearing strength when one of the panels 20, 22 or 21, 23 is used as the base.

- Such a cube 12 may preferably be used as a stool. However, it can be quite generally used as a supporting element of considerable load-bearing strength.

- In Fig. 4 a blank 50 comprises a plurality of panel portions suitable for erecting as a nursery table. The blank comprises three sections of panels, of which the centre section 76 later forms the table top. This section is connected at each end to further sections 54 each of which is to form a table support.

- 35 The blank 50 is first folded together as shown in Fig. 5. The side panels 60, 64, 68 in the two sections 54 are first folded inwards towards the centre panel 56. Similarly the panel 74 and the outer panels 40 62, 66, 70, 72 of section 76 are each folded over towards the centre panel 58.

- The side panels 60, 64, 68 are folded over to form hollow prisms, the backs of the outer panels 60 resting against the centre panel 56 and each covering one half thereof on one side. The longitudinal edges of the prisms are made to abut along the centre line of the panel 56 by placing the side panels 64 and 60 at an acute angle to each other.

- 50 The outer panels 62 are tucked inwards so that their backs rest flush on the centre section 58 which will later form the "table top". The long narrow panels 72 form the outside edges of the "table top", whereas the long narrow panels 66 make an acute angle with the panels 62. The longitudinal edges thus formed between the rectangles 62 and 66 abut along the centre line of the centre section 58. The panels 74 are then erected into a position perpendicular to the panels 70. The folding of the blank 50 is thus completed and will have the appearance illustrated in Fig. 5.

The two sections 54 must now be folded until they are perpendicular to the centre panel 58. At the same time the panels 74 are inserted into the hollow interiors of the prisms formed by the folded panels 60, 64 and 68. They co-operate with the insides of the panels 64 and thereby retain the table supports formed by the sections 54 in the required upright position.

The nursery table illustrated in Fig. 6 is thus completed.

The stability of this table is due to the formation of abutting vertical and horizontal edges of panels which support each other, as well as by horizontal panels resting on and/or being rigidified by the edges of vertical panels. When the blank 50 is cut out of corrugated paperboard this should be done in such a way that the direction of the corrugations is that in which the load on the completed table is to be supported.

Fig. 7 shows a blank 80 which is cut out of a rectangular sheet of stiff cardboard, preferably corrugated paperboard, and in which lateral incisions are made. These define three sections 86, 88 and 86 in the blank of which the two side sections 86 are congruent. The centre section is marked 88. The sections 86 each comprise a centre panel 90 which adjoins panels 92 on either side. Panels 94, having an obliquely cut edge 108, adjoin each of said panels 92 on the side opposite panel 90. The centre section 88 comprises a centre panel 96 adjoining on either side trapezium-shaped panels 98 which adjoin triangular panels 102 and nearly rectangular panels 100. The large centre panels 90 and 96 adjoin and form a continuous wide centre portion in the blank 80, whereas the adjacent narrow panels 94 and 100 are divided by incisions cut inwards from the edges of the blank 80. Moreover, each centre panel 90 has two lateral incisions 110.

For forming a table 82 (Figure 9) or an easy chair 84 (Figure 10) the blank 80 is first folded as shown in Fig. 8. The panels 94 and 100 are first folded into a position perpendicular to the portions 92 and 98. The triangular panels 102 are then folded into a position perpendicular to the trapeze-shaped panels 98. The panels 92 and 98 are then folded over inwards toward the centre panels 90 and 96 until the panels 94 are perpendicular to panels 90 and touch the centre line of the panels 90. The panels 94 now lie back to back, giving each other mutual support. Two triangular hollow prisms are thus formed, each comprising one half of the area of the panel 90 and the two panels 92 and 94. When the panels 98 have similarly been folded over inwards, the panels 100 and

102 are perpendicular to and adjacent to the panel 96, and the two panels 100 bear against each other on the centre line of the centre panel 96. Merely two triangular portions of the panel 96 remain exposed and these are divided into four right triangles by the free ends of the panels 100 which are perpendicular to and touch the centre line of the panel 96.

Finally the two side sections 86 comprising the now folded panels 90, 92 and 94 are folded into a position perpendicular to the centre panel 96. The free ends of the panels 100 are simultaneously inserted between the adjacent backs of the panels 94. A triangular part on the outside face of the panels 92 comes into contact with the outside of the triangular panels 102 and thus receives support. The fold line between the panels 98 and 102 forms an abutment for panel 92 when the side section 86 comprising panels 90, 92 and 94 is folded into a position perpendicular to centre panel 96.

In order to retain the panels 90 perpendicular to the centre panel 96 they may be tied together by a cord 104 threaded through the incisions 110. To provide further support a plate 106 (c.f. Fig. 11) with slide members 112 attached to the edges of the trapezium-shaped part 114 is pushed between the adjacent faces of the panels 94 and 100 and is held in position by friction. The length of the side of the plate 106 is so chosen that it ends flush with the free edges 108 of the two panels 94.

In an alternative embodiment (not shown) the plate 106 may be rectangular and lack slide members on its two sides. The blank 80 will then have panels 94 that are completely rectangular.

However, it is also possible to dispense with the cord 104. The plate 106 must then be wider with slits at its edges for engaging cooperating slits in the panels 90. There is then an edge projecting beyond the panels 90.

The multi-purpose folded furniture is now ready for use. If the portions 86 are used as the supports the furniture will form a table 82, whereas it can be tilted over on its side to form an easy chair, the seat being formed by the plate 106.

If corrugated paperboard is used as the raw material of the blank the latter should be so cut from the board that the corrugations extend in the direction in which the paperboard bears the load.

The stability of the easy chair 84 and the table 82 derives from the fact that fold lines at the edge of panels about other fold lines and some narrow panels stand edge-wise and perpendicular to wider panels thus supporting and stabilizing the latter.

After use the furniture illustrated in Figs. 2, 6, 9 and 10 can be collapsed at any time by undoing the tuck-in connections and flattening out the folds. The reconstituted blank can then be stored in a minimum of space.

The proposed furniture may be made of blanks cut out of cardboard or synthetic plastics materials suitable for the purpose. It can be produced in the same way and on the same machines as those used for expendable cartons.

The above embodiments therefore provide bodies that are capable of carrying major loads and that are of a suitable configuration to serve as pieces of furniture for a multiplicity of uses, or by virtue of their shape to be used as support members that will carry considerable loads for a wide variety of purposes, although their own weight is very low and in case of need they can be quite easily erected, and also when collapsed stored within a minimum of space and thus consigned or offered for sale. More particularly the use of the proposed materials reduces the accident risk. Also the last embodiment provides a multi-purpose piece of furniture that can perform the functions of at least two different kinds of furniture by virtue of its particular shape and configuration.

WHAT I CLAIM IS:—

1. A single-piece blank comprising panels separated by fold lines such that said panels can be erected by folding about said fold lines and by tuck manipulations to form stable furniture wherein some of said panels can be folded to form hollow prism shaped support elements of triangular cross-section abutting others of said panels which bear loads.

2. A single-piece blank as claimed in Claim 1 in which some of said panels can be folded such that the edges formed at the fold lines extend in a direction such as to support others of said panels which bear loads.

3. A single-piece blank as claimed in any preceding Claim in which said panels can be folded to form a cube, two of whose opposite faces are each replaced by four reentrant faces forming the sides of a pyramid, the vertices of said pyramids abutting each other at the centre of said cube.

4. A single-piece blank as claimed in Claim 3 in which four adjoining square panels forming pairs of opposite faces of the cube can be rigidified by edges formed at the fold lines of rectangular and triangular panels adjoining each other and said four square panels, some of said edges running along the diagonals of the cube

and other edges running perpendicular to the faces of the cube.

5 5. A single-piece blank as claimed in Claim 3 or 4 comprising first, second, third and fourth square panels adjoining each other in sequence to form a rectangular strip, a first flap adjoining said first square panel on the side opposite said second square panel, a second flap adjoining said fourth square panel opposite the side adjoining said third square panel, four isosceles triangular panels each adjoining along its base one side of said first or third square panels respectively, the length of the base being equal to that of a side of the square panel, four right triangular panels each adjoining along its hypotenuse the side of a respective isosceles triangular panel remote from said second square panel, the remaining sides of the right triangular panel lying parallel to and perpendicular to the sides of the square panel, four square panels each of the same length as and adjoining the edge of a respective right triangular panel lying parallel to the length of said strip, congruent first and second rectangular panels of equal length as and adjoining one on each side said second square panel, congruent third and fourth rectangular panels of half the size of said second square panel and adjoining along their lengths said first and second rectangular panels respectively on the side opposite said second square panel, congruent fifth and sixth rectangular panels of equal length as and adjoining one on each side of said fourth square panel and seventh and eighth rectangular panels adjoining lengthwise said fifth and sixth rectangular panels respectively such that said fifth, sixth, seventh and eighth rectangular panels have a slightly greater width than said first, second, third and fourth rectangular panels respectively.

6. A single-piece blank as claimed in Claim 1 or 2 in which said panels form two similar side sections and a central section such that said panels can be folded to form a table in which said central section forms the table-top supported by said two side sections forming vertical hollow prismatic support elements of triangular cross section.

7. A single-piece blank as claimed in Claim 6 in which said central section comprises a main panel forming the surface of the table-top, two narrow side panels adjoining said main panel on either side forming the edges of said table-top and four further side panels two adjoining each of said narrow side panels sequentially such that said further side panels can be folded underneath said main panel to form horizontal prism shaped support elements,

which meet on the centre line of said main panel.

8. A blank as claimed in Claim 6 or 7 comprising rectangular first, second and third panels adjoining in sequence to form a rectangular strip, said first and third panels being congruent four congruent pentagonal panels, whose shape is that of a rectangle with a right triangular extension such that the hypotenuse of said extension forms a side of the pentagon, one adjoining each of the sides of said first and third panels nearest said second panel such that the longest side of each of said first and third panels and the triangular extension is on the side nearest said second panel, four congruent intermediate rectangular panels each adjoining lengthwise one of said pentagonal panels respectively on the side opposite said first or third panel, four congruent outer rectangular panels each adjoining lengthwise one of said intermediate rectangular panels respectively on the side opposite said pentagonal panels, congruent rectangular first and second side panels each of the same length as and adjoining lengthwise one of the sides of said second panel, third and fourth side panels each of the same length as and adjoining lengthwise one of said first and second side panels respectively on the sides opposite said second panel, congruent rectangular fifth and sixth side panels of lesser length than and adjoining lengthwise said third and fourth panels centrally on the side opposite said second panel, congruent rectangular seventh and eighth side panels of the same length as and adjoining lengthwise said fifth and sixth side panels respectively as the sides opposite said second panel, four rectangular flaps adjoining said third and fourth side panels respectively such that they are on the same side as and flanking either said fifth and sixth side panels respectively.

9. A blank as claimed in claim 1 or 2 in which the panels can be folded to form a structure into which a plate can be folded to form a structure into which a plate can be inserted to form a table which may be converted into an easy chair by tipping on its side.

10. A blank as claimed in Claim 9 in which side panels can be folded to form horizontal triangular prism shaped supports on which said inserted plate rests thus forming a seat.

11. A blank as claimed in any of claims 9, 10 or 11, comprising first, second and third rectangular panels adjoining in sequence to form a rectangular strip, said first and third rectangular panels being congruent, four congruent rectangular side panels one of which adjoins each side of

5 said first and third rectangular panels along the whole of each of the sides nearest said second rectangular panel, four congruent pentagonal panels which are the shape of a rectangle with a face cut across one corner, one of which adjoins each of said rectangular side panels along the whole of the side further from said first or third rectangular panels respectively, such that the fifth side of the pentagon has been cut across the corner of the rectangle, formed by the other four sides of the pentagon, furthest from said second rectangular panel, two symmetric congruent trapezoidal panels each adjoining one side of said second panel along the base of the trapezium, four congruent triangular flaps each adjoining one side of said trapezoidal panels, two hexagonal panels of nearly rectangular shape with two right triangular exteriors at the corners nearest said second rectangular panel each adjoining the top of one of said trapezoidal panels and four incisions in said first and third rectangular panels such that two incisions are made symmetrically in the side of said first or third rectangular panel respectively which forms the lateral edge of said rectangular strip.

12. A single piece blank as claimed in any preceding claim made of stiff cardboard, corrugated paperboard or a plastics material.

13. A collapsible cube made from a blank as claimed in any one of claims 3, 4 or 5.

14. A collapsible table made from a blank as claimed in any one of claims 6, 7 and 8.

15. A collapsible piece of furniture made from a blank as claimed in any one of claims 9, 10 and 11.

16. A collapsible piece of furniture as claimed in claim 15 in which panel portions forming side supports are connected by cord to improve the stability of the furniture.

17. Collapsible furniture and blanks therefor as described herein with reference to Figures 1—3, 4—6 or 7—11 of the accompanying drawings.

TREGEAR, THIEMANN & BLEACH,
Chartered Patent Agents,
Melbourne House,
Aldwych, London, W.C.2,
Agents for the Applicant.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1970.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

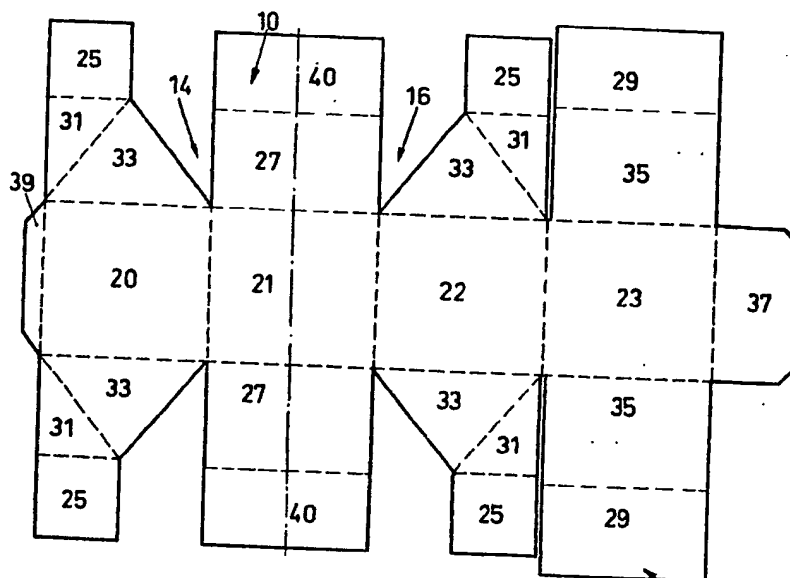


Fig.1

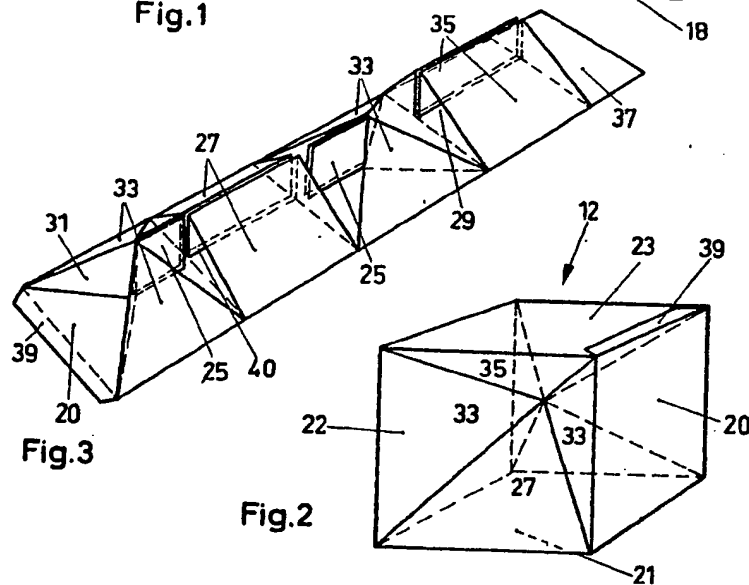


Fig.3

Fig.2

Fig.4

